

considerable number of the illustrations. Most of the voluminous material, however, was in the form of notes, lists of localities and so forth, and only a few pages were actually ready for the printer. Mrs. Tattersall resolved to undertake the heavy labour of completing the monograph, incorporating her husband's notes and preparing the rest of the drawings. It may be said at once that she has accomplished admirably her self-imposed task, and that the many friends of her late husband will be grateful to her for having provided this worthy memorial to him.

The book opens with a historical summary of the literature on the group, followed by chapters on the general morphology and bionomics. These chapters are quite competently done, although Prof. Tattersall's great experience would, no doubt, have enabled him to supplement them on many points. It would have been interesting, for example, to have had a fuller discussion of the so-called 'luminous organ', from which the genus *Gnathophausia* derives its name. In the systematic part which follows, the keys to families, genera and species seem to be well constructed, although their adequacy could only be tested by using them in the actual determination of specimens. The generic and specific diagnoses are clearly phrased and so arranged that comparison is easy. The figures are admirably clear and, from an artistic point of view, are not unworthy to be placed alongside the work of such masters of crustacean iconography as G. O. Sars and H. J. Hansen.

A valuable feature of the book is the list of localities in British seas given for each species. These lists are taken from Prof. Tattersall's notes, and, in very many cases, were authenticated by his own examination of specimens. Where this could not be done, the names of the authors responsible for the records are given. As in the case of many other groups of marine invertebrates, these lists show how patchy is our knowledge of the distribution of the littoral fauna around British shores. Very few marine laboratories have published lists of the local fauna like that available for Plymouth, and over great stretches of coastline where there are no laboratories the composition of the littoral fauna is a subject for guesswork. For example, there is some reason for believing that the fauna of the shores of the Moray Firth differs considerably from that of the rest of East Scotland; but there are very few Mysidacea recorded from it in this work.

A good deal of importance is attached to Geoffrey Smith's supposed discovery of a vestigial exopod on the mandible of *Paranaspides* (which is not, of course, a Mysidacean, as the unwary reader of p. 10 might be led to suppose). It is necessary, therefore, to say that no one has been able to confirm Smith's statements on this point and that the 'exopod' was certainly absent in the single specimen dissected by the present writer in order to search for it.

Misprints and similar errors, although not numerous, are sufficiently conspicuous to suggest inadequate proof-reading, for which, of course, the author may not be to blame: "neural" for "neural" makes nonsense on p. 360; Davis Straits is not in Scotland (p. 119), nor St. Andrews in the "north" of that country (p. 372); the maxilla is not a "thoracic" appendage (p. 300); and a very distinguished British zoologist of the last generation (or the one before that, perhaps) did not spell his name "Lancaster" (p. 433). Finally, several references in the text are not explained in the bibliography at the end of the volume.

W. T. CALMAN

NATURAL HISTORY OF GUANOS

Survey of Existing Knowledge of Biogeochemistry, 3 The Biogeochemistry of Vertebrate Excretion. By George Evelyn Hutchinson. (Bulletin of the American Museum of Natural History, Vol. 96.) Pp. xviii+554+16 plates. (New York: American Museum of Natural History, 1950.) 10 dollars.

GUANO has played a considerable part in agricultural history. The original Peruvian material began to be imported into Great Britain, in substantial amount, during the 'hungry forties' of the nineteenth century, and for more than a generation it constituted a substantial part of the total fertilizer supply. In the southern part of the United States, also, it restored the productivity of the worn-out soils of the old tobacco and cotton plantations. We now know that its effects are to be explained simply enough—it provided both phosphate and nitrogen in concentrated and readily available forms. But farmers often thought of it as something with quite miraculous properties.

Mr. G. E. Hutchinson's monograph is by far the most complete treatise on the subject, and the standard of his scientific scholarship is of the highest. He enumerates and describes the known deposits, analyses the climatological and biological conditions under which they have been formed, critically examines the great mass of literature and points to the lack of proof for some of the earlier theories and to the remaining gaps in our knowledge.

Many of the broad generalizations about guano formation are easily to be understood. Large volumes of excrement and egesta will be deposited wherever large numbers of sizable animals congregate to rest or to rear their young. Marine birds and seals yield the largest quantities of possible raw material; and in both cases a fish diet results in material with high initial contents of phosphates and of nitrogen compounds. But, other things being equal, the product from birds will have the higher value, because the excreted nitrogen is mostly in the relatively stable form of uric acid and, moreover, is in a semi-solid form that is rapidly desiccated. Preservation is tolerably complete only on rainless sites, because even moderate and occasional moistening leads to a breakdown of nitrogen compounds into volatile products. Again, the eggs and young of sea-birds are liable to wholesale destruction by land predators, so that island sites are the only ones that can support large permanent bird-colonies; certain rainless islands, however, are uncolonized because soil or rock surfaces reach day temperatures that are lethal to developing embryos.

In many cases the population of guano birds shows marked cyclical changes—usually a gradual build-up followed by holocaust. The latter does not seem to result from a build-up either of birds of prey or of parasites, and famine rather than epidemic disease seems to be the common cause. The catastrophic falls are more marked among surface-feeders than among deep-diving species, and may thus probably be related to changes in the size and frequency of shoals of shallow-swimming fish. Where the chief food of a particular surface-feeding bird is a species of fish that swims at depths which vary according to the relative temperatures of the upper and lower waters, the immediate cause of catastrophe might be, for example, a persistent high temperature of the uppermost layer of the sea. It is thus tempting to

believe that the ultimate cause of the bird's population cycle is to be sought in a regular cyclical change in ocean currents. But catastrophes do not seem to occur with the degree of regularity that would be expected on such a hypothesis.

Mr. Hutchinson's study will be of great interest to students of animal population.

J. A. SCOTT WATSON

THE GORILLA

The Anatomy of the Gorilla

The Studies of Henry Cushier Raven, and Contributions by William B. Atkinson, Herbert Elftman, John Eric Hill, Adolph H. Schultz, William L. Straus, Jr., and S. L. Washburn. Arranged and edited by William King Gregory. (The Henry Cushier Raven Memorial Volume: a Collaborative Work of the American Museum of Natural History and Columbia University.) Pp. viii+259 (116 plates). (New York: Columbia University Press; London: Oxford University Press, 1950.) 97s. 6d. net.

AT the time of his death in 1944, Henry Raven was curator of the Department of Comparative Anatomy of the American Museum of Natural History. He had been a naturalist from boyhood and had visited many parts of the world in search of birds and mammals for the American Museum. In 1929 he returned from an expedition to Africa with a collection of 'pickled' gorillas and also a young live chimpanzee, which soon became a celebrated character in New York. She lived in the Raven house, and took part in a number of Raven's public lectures on anthropoid life. From this time on, his interests became increasingly fixed on the primates, and during the ensuing years he devoted much time to the anatomical study of the gorillas which he had brought back from the jungles of the Belgian Congo and the Cameroons. His death occurred before the completion of his task, and the present volume is a record of his own descriptions of the muscles, blood vessels, peripheral nerves and reproductive organs, supplemented by notes provided by the late J. E. Hill. Raven was primarily interested in regional anatomy, and his descriptions do not attempt to correlate form with function, nor to compare the anatomy of the gorilla with that of man and other primate types. The volume has been rounded-off with short contributions on the thoracic viscera, by S. L. Washburn; on the abdominal viscera and female reproductive system, by H. Elftman and W. B. Atkinson; on the skin, by W. L. Straus; and on the skull, teeth, palatine ridges and growth, by A. H. Schultz.

Raven's detailed descriptions of the musculature of the gorilla are accompanied by a magnificent series of plates and line drawings, many of which were prepared under his personal supervision. Partly, however, because of his premature death, the balance of his section of the volume is uneven. Thus, in contrast to the detail with which he treats the muscles, he devotes only a few pages to the vascular and reproductive systems. The osteology of the gorilla—a subject of great importance in the study of primate fossils—is dealt with scarcely at all. This lack of balance is unfortunately not corrected by the supplementary chapters in the book which, while they also provide excellent and much-needed inform-

ation, again deal only with limited aspects of the subject.

Dr. W. K. Gregory points out in a foreword that Raven began his dissections of the gorilla with the object of providing a "comprehensive anatomy of this great near relative of man". There can be no doubt that, while he was prevented from doing this, he has nevertheless left what the fly-leaf calls a "permanent definitive work in this field". In the chapter which he has provided, Prof. Schultz remarks that "the literature on gorillas contains many premature generalisations supported by far too few observations". In as highly variable an animal as the gorilla, he goes on to say, "large series of specimens must be investigated in order to establish really representative averages and to find the full ranges of individual variations". The anatomy of the great apes has never been studied, as he indicates, on a scale commensurate with the prominent position these animals occupy in discussions on human evolution. The Raven Memorial Volume helps to show how small is the area of anatomical fact on which these evolutionary discussions are based, and how much needs to be done to strengthen the factual foundation on which has been built so large and detailed a superstructure of phylogenetic speculation.

NEO-VITALISM AND FARMING

Food, Farming and the Future

By Friend Sykes. Pp. 294. (London: Faber and Faber, Ltd., 1951.) 21s. net.

OF late years there has been a revival in certain agricultural circles of the old vitalistic ideas formerly widely held until Wöhler's synthesis of urea broke down the distinction between substances which could be prepared in the laboratory and those which could not, but required the intervention of a living organism. Broadly speaking, the position of their successors to-day is that the nutrient salts considered by modern plant physiologists as necessary and sufficient for the full growth of plants are in reality not so, but they need in addition some vital principle which has hitherto eluded chemists and physiologists. In addition to the well-recognized continuity of life through the seed, there is another continuity through the nutrients, and unless these have recently formed part of some living organism the plant, though morphologically complete, lacks some essential quality; in particular, it becomes susceptible to disease, and if fed to animals or human beings induces a like susceptibility in them.

The idea was put forward by the late Sir Albert Howard, and its element of mysticism and supposed naturalness at once made an appeal; it was taken up by a group of able and persuasive advocates of whom Mr. Friend Sykes, the author of the present volume, is one of the best known. He has already written "Humus and the Farmer" and had not intended producing another book on the subject; but his correspondence showed that further clarification was necessary, and this he has set out to effect.

Mr. Sykes's farming system consists in growing a four-year ley which, as in the Clifton Park system, includes some deep-rooting plants, and then ploughing up and growing cereals for four years. The straw is converted into farmyard manure in the old-fashioned way by wintering cattle in stock yards, and the manure thus produced is given to the potatoes,